

application of protective current. The voltage shift must be determined in accordance with sections II and IV of this appendix.

(2) Except as provided in paragraphs (3) and (4) of this paragraph, a minimum negative (cathodic) polarization voltage shift of 100 millivolts. This polarization voltage shift must be determined in accordance with sections III and IV of this appendix.

(3) Notwithstanding the alternative minimum criteria in paragraphs (1) and (2) of this paragraph, aluminum, if cathodically protected at voltages in excess of 1.20 volts as measured with reference to a copper-copper sulfate half cell, in accordance with section IV of this appendix, and compensated for the voltage (IR) drops other than those across the structure-electrolyte boundary may suffer corrosion resulting from the build-up of alkali on the metal surface. A voltage in excess of 1.20 volts may not be used unless previous test results indicate no appreciable corrosion will occur in the particular environment.

(4) Since aluminum may suffer from corrosion under high pH conditions, and since application of cathodic protection tends to increase the pH at the metal surface, careful investigation or testing must be made before applying cathodic protection to stop pitting attack on aluminum structures in environments with a natural pH in excess of 8.

C. *Copper structures.* A minimum negative (cathodic) polarization voltage shift of 100 millivolts. This polarization voltage shift must be determined in accordance with sections III and IV of this appendix.

D. *Metals of different anodic potentials.* A negative (cathodic) voltage, measured in accordance with section IV of this appendix, equal to that required for the most anodic metal in the system must be maintained. If amphoteric structures are involved that could be damaged by high alkalinity covered by paragraphs (3) and (4) of paragraph B of this section, they must be electrically isolated with insulating flanges, or the equivalent.

II. *Interpretation of voltage measurement.* Voltage (IR) drops other than those across the structure-electrolyte boundary must be considered for valid interpretation of the voltage measurement in paragraphs A(1) and (2) and paragraph B(1) of section I of this appendix.

III. *Determination of polarization voltage shift.* The polarization voltage shift must be determined by interrupting the protective

current and measuring the polarization decay. When the current is initially interrupted, an immediate voltage shift occurs. The voltage reading after the immediate shift must be used as the base reading from which to measure polarization decay in paragraphs A(3), B(2), and C of section I of this appendix.

IV. *Reference half cells.* A. Except as provided in paragraphs B and C of this section, negative (cathodic) voltage must be measured between the structure surface and a saturated copper-copper sulfate half cell contacting the electrolyte.

B. Other standard reference half cells may be substituted for the saturated copper-copper sulfate half cell. Two commonly used reference half cells are listed below along with their voltage equivalent to -0.85 volt as referred to a saturated copper-copper sulfate half cell:

(1) Saturated KCl calomel half cell: -0.78 volt.

(2) Silver-silver chloride half cell used in sea water: -0.80 volt.

C. In addition to the standard reference half cells, an alternate metallic material or structure may be used in place of the saturated copper-copper sulfate half cell if its potential stability is assured and if its voltage equivalent referred to a saturated copper-copper sulfate half cell is established.

[Amdt. 192-4, 36 FR 12305, June 30, 1971]

#### APPENDIX E TO PART 192—GUIDANCE ON DETERMINING HIGH CONSEQUENCE AREAS AND ON CARRYING OUT REQUIREMENTS IN THE INTEGRITY MANAGEMENT RULE

##### I. GUIDANCE ON DETERMINING A HIGH CONSEQUENCE AREA

To determine which segments of an operator's transmission pipeline system are covered for purposes of the integrity management program requirements, an operator must identify the high consequence areas. An operator must use method (1) or (2) from the definition in §192.903 to identify a high consequence area. An operator may apply one method to its entire pipeline system, or an operator may apply one method to individual portions of the pipeline system. (Refer to figure E.I.A for a diagram of a high consequence area).

## Determining High Consequence Area

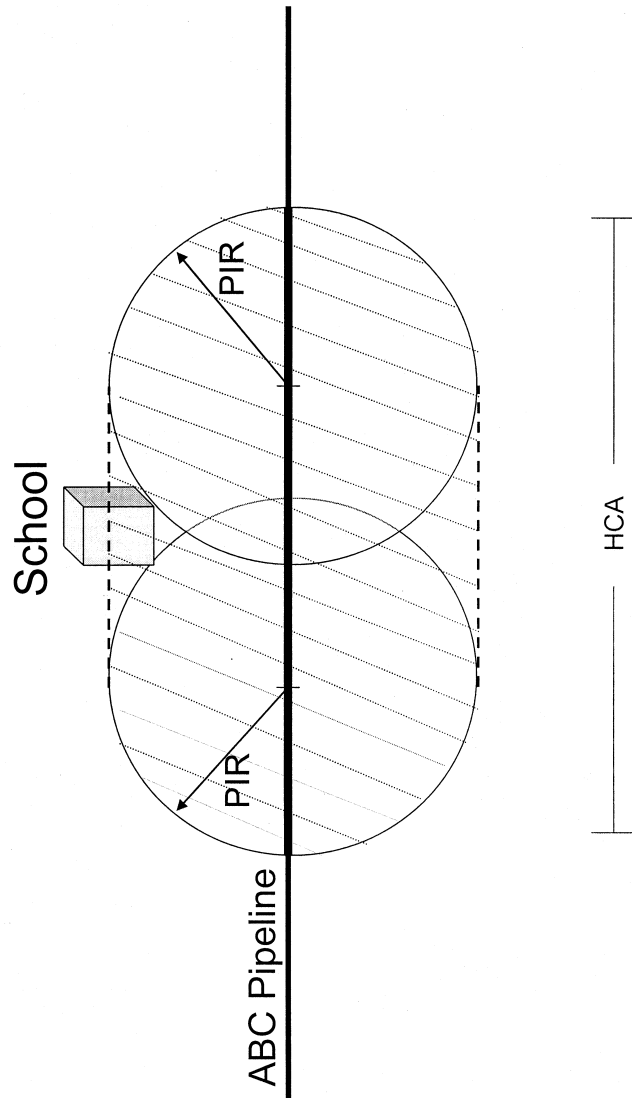


Figure E.I.A

### II. GUIDANCE ON ASSESSMENT METHODS AND ADDITIONAL PREVENTIVE AND MITIGATIVE MEASURES FOR TRANSMISSION PIPELINES

(a) Table E.II.1 gives guidance to help an operator implement requirements on additional preventive and mitigative measures for addressing time dependent and independent threats for a transmission pipeline operating below 30% SMYS not in an HCA

(i.e. outside of potential impact circle) but located within a Class 3 or Class 4 Location.

(b) Table E.II.2 gives guidance to help an operator implement requirements on assessment methods for addressing time dependent and independent threats for a transmission pipeline in an HCA.

(c) Table E.II.3 gives guidance on preventative & mitigative measures addressing time

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dependent and independent threats for transmission pipelines that operate below 30% SMYS, in HCAs.

**Table E.II.1: Preventive and Mitigative Measures for Transmission Pipelines Operating Below 30% SMYS not in an HCA but in a Class 3 or Class 4 Location**

(Column 1) Threat	Existing 192 Requirements		(Column 4) Additional (to 192 requirements) Preventive and Mitigative Measures
	(Column 2) Primary	(Column 3) Secondary	
External Corrosion	455-(Gen. Post 1971), 457-(Gen. Pre-1971) 459-(Examination), 461-(Ext. coating) 463-(CP), 465-(Monitoring) 467-(Elect isolation), 469-Test stations) 471-(Test leads), 473-(Interference) 479-(Atmospheric), 481-(Atmospheric) 485-(Remedial), 705-(Patrol) 706-(Leak survey), 711 (Repair – gen.) 717-(Repair – perm.)	603-(Gen Oper'n) 613-(Surveillance)	For Cathodically Protected Transmission Pipeline:  • Perform semi-annual leak surveys.  For Unprotected Transmission Pipelines or for Cathodically Protected Pipe where Electrical Surveys are Impractical:  • Perform quarterly leak surveys
Internal Corrosion	475-(Gen IC), 477-(IC monitoring) 485-(Remedial), 705-(Patrol) 706-(Leak survey), 711 (Repair – gen.) 717-(Repair – perm.)	53(a)-(Materials) 603-(Gen Oper'n) 613-(Surveillance)	• Perform semi-annual leak surveys.

3 <sup>rd</sup> Party Damage	103-(Gen. Design), 111-(Design factor) 317-(Hazard prot), 327-(Cover) 614-(Dam. Prevent), 616-(Public education) 705-(Patrol), 707-(Line markers) 711 (Repair – gen.), 717-(Repair – perm.)	615-(Emerg. Plan)	<ul style="list-style-type: none"> <li>• Participation in state one-call system.</li> <li>• Use of qualified operator employees and contractors to perform marking and locating of buried structures and in direct supervision of excavation work, AND</li> <li>• Either monitoring of excavations near operator's transmission pipelines, or bi-monthly patrol of transmission pipelines in class 3 and 4 locations. Any indications of unreported construction activity would require a follow up investigation to determine if mechanical damage occurred.</li> </ul>
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Table E.II.2 Assessment Requirements for Transmission Pipelines in HCAs (Re-assessment intervals are maximum allowed)

	Re-Assessment Requirements (see Note 3)					
	At or above 50% SMYS		At or above 30% SMYS up to 50% SMYS		Below 30% SMYS	
	Max Re-Assessment Interval	Assessment Method	Max Re-Assessment Interval	Assessment Method	Max Re-Assessment Interval	Assessment Method
Pressure Testing	7	CDA	7	CDA	Ongoing	Preventative & Mitigative (P&M) Measures (see Table E.II.3), (see Note 2)
	10	Pressure Test or ILI or DA				
		Repeat inspection cycle every 10 years	15(see Note 1)	Pressure Test or ILI or DA (see Note 1)		
				Repeat inspection cycle every 15 years	20	Pressure Test or ILI or DA
						Repeat inspection cycle every 20 years
In-Line Inspection	7	CDA	7	CDA	Ongoing	Preventative & Mitigative (P&M) Measures (see Table E.II.3), (see Note 2)
	10	ILI or DA or Pressure Test				
		Repeat inspection cycle	15(see Note 1)	ILI or DA or Pressure Test (see Note 1)		
		every 10 years		Repeat inspection cycle every 15 years	20	ILI or DA or Pressure Test

							Repeat inspection cycle every 20 years
Direct Assessment	7	CDA	7	CDA	Ongoing	Preventative & Mitigative (P&M) Measures (see Table E.II.5), (see Note 2)	Repeat inspection cycle every 20 years
	10	DA or ILI or Pressure Test					
			15(see Note 1)	DA or ILI or Pressure Test (see Note 1)			
		Repeat inspection cycle every 10 years		Repeat inspection cycle every 15 years	20	DA or ILI or Pressure Test	Repeat inspection cycle every 20 years

Note 1: Operator may choose to utilize CDA at year 14, then utilize ILI, Pressure Test, or DA at year 15 as allowed under ASME B31.8S

Note 2: Operator may choose to utilize CDA at year 7 and 14 in lieu of P&M

Note 3: Operator may utilize "other technology that an operator demonstrates can provide an equivalent understanding of the condition of line pipe"

Table E.II.3

Preventative &amp; Mitigative Measures addressing Time Dependent and Independent Threats for Transmission Pipelines that Operate Below 30% SMYS , in HCAs

Threat	Existing 192 Requirements		Additional (to 192 requirements) Preventive & Mitigative Measures
	Primary	Secondary	
External Corrosion	455-(Gen. Post 1971)		<u>For Cathodically Protected Trmn. Pipelines</u> <ul style="list-style-type: none"> <li>Perform an electrical survey (i.e. indirect examination tool/method) at least every 7 years. Results are to be utilized as part of an overall evaluation of the CP system and corrosion threat for the covered segment. Evaluation shall include consideration of leak repair and inspection records, corrosion monitoring records, exposed pipe inspection records, and the pipeline environment.</li> </ul>
	457-(Gen. Pre-1971)		
	459-(Examination)		
	461-(Ext. coating)	603-(Gen Oper)	
	463-(CP)	613-(Surveil)	
	465-(Monitoring)		
	467-(Elect isolation)		

External Corrosion	469-(Test stations) 471-(Test leads) 473-(Interference) 479-(Atmospheric) 481-(Atmospheric) 485-(Remedial) 705-(Patrol) 706-(Leak survey) 711 (Repair – gen.) 717-(Repair – perm.)		<p><u>For Unprotected Trmm. Pipelines or for Cathodically Protected Pipe where Electrical Surveys are Impracticable</u></p> <ul style="list-style-type: none"> <li>• Conduct quarterly leak surveys AND</li> <li>• Every 1-1/2 years, determine areas of active corrosion by evaluation of leak repair and inspection records, corrosion monitoring records, exposed pipe inspection records, and the pipeline environment.</li> </ul>
Internal Corrosion	475-(Gen IC) 477-(IC monitoring) 485-(Remedial) 705-(Patrol) 706-(Leak survey) 711 (Repair – gen.) 717-(Repair – perm.)	53(a)-(Materials) 603-(Gen Oper) 613-(Surveil)	<ul style="list-style-type: none"> <li>• Obtain and review gas analysis data each calendar year for corrosive agents from transmission pipelines in HCAs,</li> <li>• Periodic testing of fluid removed from pipelines. Specifically, once each calendar year from each storage field that may affect transmission pipelines in HCAs, AND</li> <li>• At least every 7 years, integrate data obtained with applicable internal corrosion leak records, incident reports, safety related condition reports, repair records, patrol records, exposed pipe reports, and test records.</li> </ul>



3 <sup>rd</sup> Party Damage	103-(Gen. Design) 111-(Design factor) 317-(Hazard prot) 327-(Cover) 614-(Dam. Prevent) 616-(Public educat) 705-(Patrol) 707-(Line markers) 711 (Repair – gen.) 717-(Repair – perm.)	615 –(Emerg Plan)	<ul style="list-style-type: none"> <li>• Participation in state one-call system,</li> <li>• Use of qualified operator employees and contractors to perform marking and locating of buried structures and in direct supervision of excavation work, AND</li> <li>• Either monitoring of excavations near operator’s transmission pipelines, or bi-monthly patrol of transmission pipelines in HCAs or class 3 and 4 locations. Any indications of unreported construction activity would require a follow up investigation to determine if mechanical damage occurred.</li> </ul>
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[Amdt. 192–95, 69 FR 18234, Apr. 6, 2004, as amended by Amdt. 192–95, May 26, 2004]

**PART 193—LIQUEFIED NATURAL GAS FACILITIES: FEDERAL SAFETY STANDARDS**

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- 193.2003 [Reserved]
- 193.2005 Applicability.
- 193.2007 Definitions.
- 193.2009 Rules of regulatory construction.
- 193.2011 Reporting.
- 193.2013 Incorporation by reference.
- 193.2015 [Reserved]
- 193.2017 Plans and procedures.
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**Subpart B—Siting Requirements**

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- 193.2055 [Reserved]
- 193.2057 Thermal radiation protection.
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- 193.2067 Wind forces.
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- 193.2101 Scope.

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**IMPOUNDMENT DESIGN AND CAPACITY**

- 193.2155 Structural requirements.
- 193.2157–193.2159 [Reserved]
- 193.2161 Dikes, general.
- 193.2163–193.2165 [Reserved]
- 193.2167 Covered systems.
- 193.2169–193.2171 [Reserved]
- 193.2173 Water removal.
- 193.2175–193.2179 [Reserved]
- 193.2181 Impoundment capacity: LNG storage tanks.
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- 193.2187 Nonmetallic membrane liner.
- 193.2189–193.2233 [Reserved]

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- 193.2301 Scope.
- 193.2303 Construction acceptance.
- 193.2304 Corrosion control overview.

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- 193.2305–193.2319 [Reserved]
- 193.2321 Nondestructive tests.
- 193.2323–193.2329 [Reserved]

**Subpart E—Equipment**

- 193.2401 Scope.

**VAPORIZATION EQUIPMENT**

- 193.2403–193.2439 [Reserved]
- 193.2441 Control center.
- 193.2443 [Reserved]
- 193.2445 Sources of power.

**Subpart F—Operations**

- 193.2501 Scope.
- 193.2503 Operating procedures.
- 193.2505 Cooldown.
- 193.2507 Monitoring operations.
- 193.2509 Emergency procedures.
- 193.2511 Personnel safety.
- 193.2513 Transfer procedures.
- 193.2515 Investigations of failures.
- 193.2517 Purging.
- 193.2519 Communication systems.
- 193.2521 Operating records.

**Subpart G—Maintenance**

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- 193.2603 General.
- 193.2605 Maintenance procedures.
- 193.2607 Foreign material.
- 193.2609 Support systems.
- 193.2611 Fire protection.
- 193.2613 Auxiliary power sources.
- 193.2615 Isolating and purging.
- 193.2617 Repairs.
- 193.2619 Control systems.
- 193.2621 Testing transfer hoses.
- 193.2623 Inspecting LNG storage tanks.
- 193.2625 Corrosion protection.
- 193.2627 Atmospheric corrosion control.
- 193.2629 External corrosion control: buried or submerged components.
- 193.2631 Internal corrosion control.
- 193.2633 Interference currents.
- 193.2635 Monitoring corrosion control.
- 193.2637 Remedial measures.
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- 193.2705 Construction, installation, inspection, and testing.
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- 193.2717 Training: fire protection.
- 193.2719 Training: records.